1 Mission, Mandates, and Planning Process

1.1 Introduction

The Department of Conservation and Recreation (DCR), Division of Water Supply Protection (DWSP), Office of Watershed Management (OWM) produces Land Management Plans for each of the watersheds under its care and control – Quabbin Reservoir, Ware River, Wachusett Reservoir, and the Sudbury Reservoir – on a rotating ten year schedule. This *2007-2017 Quabbin Land Management Plan* provides principles from the current state of the science of watershed and natural resources management, agency goals for the ten year period, and specific objectives for accomplishing these in the areas of Land Protection, Forest Management, Wildlife Management, Management and Protection of Biodiversity, and Cultural Resources Protection. The plan builds on advancements in science and management techniques, the agency's own experience over six decades of managing the watershed and its resources, and accumulated input from advisory groups and the general, concerned public. It is designed as an adaptive plan, utilizing annual reviews to build immediately on new information and changes in the science that supports management decisions, and to revise objectives, as necessary, within the ten-year time frame of the plan.

1.2 Organizational Structure

The DWSP / OWM and its predecessors have had a long tenure of providing high quality drinking water to the citizens of Massachusetts. There are a variety of laws under which DWSP must work as a drinking water supply manager. DWSP is also responsible for implementing its own regulations in its efforts to protect the drinking water source for more than a third of the citizens of the Commonwealth.

1.2.1 History

During the nineteenth century, the Boston area had obtained water mostly from Lake Cochituate in Natick, a reservoir completed in 1848 under the auspices of the Boston Water Board. Some communities were also served by the Mystic Lakes. By 1878, public health officials determined that these sources of supply would prove inadequate, so a system of seven reservoirs to supplement the Cochituate system was constructed by the Boston Water Board. These new reservoirs, created by holding back portions of the Sudbury River, were: Sudbury, Whitehall, Hopkinton, Ashland, Stearns, Brackett, and Foss (the last three referred to respectively as Framingham Reservoirs Nos. 1, 2 and 3).

Limited yield, urbanization of the watersheds, and unsatisfactory water quality led to an investigation for additional water supply of satisfactory quantity and quality. A study completed by the state health board in 1895 recommended the development of a reservoir along the South Branch of the Nashua River. The Metropolitan Water Board was created in 1895 with the planning and development of the Wachusett Reservoir. The Wachusett Dam and Reservoir were completed in 1908, harnessing the Nashua River in central Massachusetts as the new source of drinking water for metropolitan Boston.

The Metropolitan Water Board, Sewer Board, and Parks Commission were combined by the Commonwealth as the Metropolitan District Commission (MDC) in 1919. State officials realized during the 1920s that, once again, additional sources of water were needed to serve the growing needs of Eastern Massachusetts. The Quabbin Reservoir was created in the 1930s, using the Winsor Dam to impound the Swift River and flood an area formerly occupied by the four Western Massachusetts towns of Dana, Enfield, Greenwich, and Prescott. The Ware River was also identified as a source of water, which could be used from October through June when flows in the river are sufficient for diversion and there is demonstrated need. Diversions of water from the Ware River are conveyed into the Quabbin Reservoir through the Quabbin tunnel aqueduct at Shaft 11A.

The creation of the Wachusett and Quabbin Reservoirs meant that increasingly substandard source waters from many of the reservoirs in the Sudbury System could be discontinued. The Whitehall, Hopkinton,

Ashland and Lake Cochituate Reservoirs were transferred in 1947 for use as State Parks. The entire Sudbury System was officially removed from active use and classified as an emergency water supply in 1976. Today only the northern reservoirs (Sudbury and Reservoir No. 3) are classified as a reserve drinking water supply.

In 1984, the Massachusetts legislature, under Chapter 372 of the Acts of 1984, divided the former MDC Water Division into the MDC Division of Watershed Management and the Waterworks Division of the Massachusetts Water Resources Authority (MWRA). The MDC/DWM became responsible for reservoir watershed operation and management to provide a safe and sufficient supply of water to the MWRA. The MWRA became responsible for the treatment, transmission, and distribution of this water. The MDC merged with the Department of Environmental Management (DEM) in 2003 to become the Department of Conservation and Recreation (see the next section for more details).

Since water started flowing from Quabbin Reservoir in 1948, no new sources of drinking water have been required to meet the water supply needs of metropolitan Boston. Through ongoing improvements of the distribution system by the MWRA and watershed management by DCR and its predecessors, the current prognosis is that the DCR/MWRA watershed system will provide adequate supply and delivery to the MWRA member communities well into the 21st century.

1.2.2 The Department of Conservation and Recreation

The Department of Conservation and Recreation (DCR) was created in July 2003 when the legislature merged the Metropolitan District Commission (MDC) and the Department of Environmental Management (DEM). Chapter 26 of the Acts of 2003, §290 transferred the responsibilities of the former MDC Division of Watershed Management entirely to the Office of Watershed Management within the Division of Water Supply Protection. The names have changed, but the primary mission of DWSP remains constant: to provide pure water through responsible watershed management. The DCR/DWSP Office of Watershed Management, like the former MDC Division of Watershed Management, is legislatively mandated to manage and protect the drinking water supply watersheds, providing pure drinking water for distribution by the MWRA to approximately 2.2 million residents of Massachusetts.

Appropriate changes in terminology have been made throughout this document. In most cases the phrase "the Division" or the acronym DWSP is used to reference both the current and former watershed management agency within the Department of Conservation and Recreation. In some contexts, particularly in historical discussions or referencing studies and publications, the terms "Metropolitan District Commission/Division of Watershed Management," MDC and MDC/DWM remain accurate. In the context of this plan, "the Division" always refers to the Division of Water Supply Protection's Office of Watershed Management or the former Division of Watershed Management, not to any other Division in the Commonwealth. The terms "Division lands" refer to properties that are owned by the Commonwealth of Massachusetts and are under the care and control of the Division of Water Supply Protection, Office of Watershed Management.

1.2.3 Memorandum of Understanding with MWRA

There is a well established working relationship between DCR and MWRA. MWRA's ratepayers entirely fund the Office of Watershed Management's annual $30 million budget, including costs associated with land acquisition and payments in lieu of taxes. The terms of this relationship are defined in a Memorandum of Understanding (MOU) between the two agencies. The latest version of this MOU, developed soon after the creation of DCR, was signed into effect in April, 2004 (see Appendix). A key provision of the updated MOU is the requirement for an annual work plan and budget to detail all of the Office of Watershed Management's functions.

1.2.4 Water Supply Protection Trust

The legislature further enhanced the ability of the Office of Watershed Management to maintain the drinking water supply by establishing a Water Supply Protection Trust, created by Chapter 149 of the Acts of 2004, §27, and written into the general laws at MGL c. 10, §73. The trust provides a more efficient mechanism for MWRA's funding of the Office of Watershed Management. The Trust has also allowed the Office of Watershed Management to fill a wide range of critical positions that were previously frozen due to state budget constraints.

The Water Supply Protection Trust has a five person board of trustees responsible for approving the Office of Watershed Management's annual work plan and budget each spring for the following fiscal year beginning July 1. The members of the board of trustees are the Secretary of the Executive Office of Energy and Environmental Affairs, the Executive Director of the MWRA, the chairperson of the MWRA Advisory Board, a representative jointly selected by the North Worcester County Quabbin Anglers Association, Inc. and the Quabbin Fishermen's Association, Inc., and a representative from the Swift River Valley Historical Society.

1.3 Mission

The Office of Watershed Management within the Division of Water Supply Protection of the Department of Conservation and Recreation, a state agency within the Executive Office of Energy and Environmental Affairs, has been charged by Chapter 26 of the Acts of 2003, §290 with protection of the Quabbin Reservoir, Ware River, Wachusett Reservoir, and Sudbury Reservoir watersheds. The Office of Watershed Management inherits the mission derived from the MDC Division of Watershed Management's enabling legislation and subsequent amendments, found at MGL c. 92A ½ , §2. The statute directs the DWSP to:

> ...construct, maintain and operate a system of watersheds, reservoirs, water rights and rights in sources of water supply [to] supply thereby a sufficient supply of pure water to the Massachusetts Water Resources Authority, and [to] utilize and conserve said water and other natural resources to protect, preserve and enhance the environment of the Commonwealth and to assure the availability of pure water for future generations.

The body of legislation makes directives on specific management aspects of the watersheds, authorizing DWSP to:

- Have the exclusive right and control over all ponds, reservoirs, and other property within the watershed system, and [may] order all persons to keep from entering in, upon or over the waters thereof and the lands of the commonwealth or towns surrounding same.
- Make rules and regulations for the protection of the watersheds.
- Establish the Quabbin Watershed Advisory Committee, the Watershed System Advisory Committee (covering Wachusett and Sudbury watersheds), and the Ware River Watershed Advisory Committee.
- Adopt periodic watershed management plans to provide for forestry, water yield, and public access among other purposes.

Beyond its broad mandate, DWSP has additional, specific responsibilities as provided in various legislative acts. Some of the acts most currently relevant to DWSP are listed in **Table 1**.

Building on the legislatively-defined mission, DWSP's charge today is:

- To maintain and operate the source facilities (including dams) safely and efficiently.
- To preserve and improve water quality of the supply sources, through regulation, direct action, and cooperation, as needed to protect public health and to meet state and federal water quality standards.

- To fulfill the watershed protection and management requirements associated with drinking water regulations.
- To implement the specific directives of the legislature, such as providing recreation opportunities balanced with the protection of the water supply sources and promulgating and enforcing rules and regulations for DWSP lands and for protected zones.
- To involve watershed towns, residents, and the public in appropriate ways in the conduct of the DWSP's watershed management functions.

In addition, DWSP has defined water quality goals for the system:

- Primary Goals
  - To prevent waterborne disease.
  - To maintain a high quality source water.
  - To meet the source water coliform criterion.

- Secondary Goals
  - To reduce/control nutrient inputs to the reservoir.
  - To reduce risk of a chemical or hazardous material spill.
  - To control general pollutant transport into the reservoir.

Together, the mission and water quality goals provide the basis for all of DWSP's activities.

1.4 Regulatory Framework

1.4.1 DWSP Related Acts and Regulations

The Massachusetts Legislature has passed numerous laws over the past century to ensure an adequate and safe flow of drinking water to the metropolitan Boston region. These Acts range from enabling the construction of Wachusett and Quabbin Reservoirs to defining membership on advisory boards to regulating access to water supply lands and land use activities in the watershed. See **Table 1** for a comprehensive list of legislative acts relevant to DWSP. The creation of different agencies and authorities over time, as described in Section 1.2, is an important milestone in the evolution of this drinking water supply. Two acts that have had a significant impact on how DWSP protects and manages these water supply resources are the Kelly-Wetmore Act and the Watershed Protection Act.

The Kelley-Wetmore Act (Chapter 737 of the Acts of 1972) (see **Appendix II**) dictates the type of public access allowed and the rules for management on the Quabbin Reservoir and Ware River watersheds ("the district"). Sample guidance in this law includes the following:

- "The natural ecology of the district shall be maintained, and it shall be conserved in its present degree of wilderness character and shall be protected in its flora and fauna in all reasonable ways to assure the balanced wildlife habitat…"
- "No new or additional roads or ways shall be constructed…excepting as shall be required for forest management and fire control or for watershed and reservoir purposes, nor shall existing soft surface roads or ways be hard surfaced, provided, however, that existing ways may be maintained and kept passable and in repair."
- "The commissioner or his designee shall annually prepare a plan detailing forestry activities…which plan shall be open to inspection by the public."
- "Lumbering or logging operations shall be permitted within the district to the extent and for the purpose of maintaining and conserving its forests in a healthful state of natural ecological balance…"

Table 1: Legislative Acts Relevant to the DWSP Office of Watershed Management

Source	Summary
Chapter 488 of the Acts of 1895	Creates Metropolitan Water Board, with diverse duties and authorities, including construction of Wachusett Reservoir by taking waters of the Nashua River.
Chapter 168 of the Acts of 1901, §§ 1,5	Creates Metropolitan Water and Sewage Board.
Chapter 350 of the Acts of 1919, §123	Creates MDC.
Chapter 321 of the Acts of 1927	Authorizes creation of Quabbin Reservoir by taking waters of the Swift River; and diverse related activities.
Chapter 21 of the Acts of 1931, §1	Grants bird management authority.
Chapter 77 of the Acts of 1932	Authorizes removal of game fish from Wachusett for stocking purposes.
Chapter 262 of the Acts of 1932	Authorizes sewer construction.
Chapter 421 of the Acts of 1946	Permits fishing in certain parts of the Quabbin Reservoir (from the shore).
Chapter 300 of the Acts of 1947	Amends c. 421 of the Acts of 1946 to allow adoption of regulations governing fishing and water supply protection.
Chapter 737 of the Acts of 1972 (Kelly-Wetmore)	Sets forth rules for the management of Quabbin and Ware lands.
Chapter 204 of the Acts of 1975	Allows MDC administrative rights of entry similar to those of the DEP Division of Water Pollution Control.
Chapter 797 of the Acts of 1979	Requires Payment in Lieu of Taxes (PILOT Payments) to municipalities.
Chapter 372 of the Acts of 1984	Creates DWM (and MWRA), with diverse duties and authority.
Chapter 734 of the Acts of 1985	Adds to the list of organizations from which QWAC membership may be nominated.
Chapter 436 of the Acts of 1990	Amends c. 737 of the Acts of 1972 to allow hunting in accordance with a deer management program.
Chapter 36 of the Acts of 1992 (Watershed Protection Act)	Establishes land use restrictions around water features in Quabbin, Ware and Wachusett; land acquisition authority and related provisions.
Chapter 242 of the Acts of 1995, §§ 2, 3	Creates Ware River Watershed Advisory Committee.
Chapter 26 of the Acts of 2003, §290	Creates Department of Conservation and Recreation, Division of Water Supply Protection.
Chapter 149 of the Acts of 2004, §27	Creates Watershed Trust.

Source: DCR/DWSP/OWM, 2005.

The Watershed Protection Act (WsPA, Chapter 36 of the Acts of 1992) established a comprehensive scheme to regulate land use and activities within certain critical areas of the Quabbin Reservoir, Wachusett Reservoir and Ware River watersheds. Some of the strategies used by the WsPA to minimize the effects of human activities on water quality include: preserving a buffer zone along the water resources, limiting impervious surfaces, and restricting the storage and use of hazardous materials. DWSP utilizes the WsPA to avoid detrimental land uses close to water resources and guide development into more appropriate locations, densities and configurations.

The passage of the Watershed Protection Act provided the opportunity to unify various watershed protection regulations into 350 CMR 11.00. While the first eight sections of these regulations specifically relate to the WsPA, 350 CMR 11.09 provides the agency the general authority to protect the water supply from pollutants (See **Appendix II;** please note that any reference to "the Commission" in these regulations is now DCR). The WsPA also authorized a $135 million bond for land acquisition, to be spent at a rate of $8 million per year. $100 million was spent before the remaining $35 million was integrated into the 2002 Environmental Bond.

1.4.2 Other Regulatory Requirements

A variety of federal and state regulations exist that pertain to drinking water watershed protection. OWM staff diligently work to comply with these laws. See **Table 2** for a list of these laws.

The federal Safe Water Drinking Act and its Surface Water Treatment Rules are of particular concern to OWM. The Surface Water Treatment Rules (SWTR) regulations were promulgated in June 1989 to reduce the risk of waterborne disease from microbial pathogens. The SWTR provides two paths for adequate public health protection. It requires filtration for all surface drinking water supplies, unless the water supply is of very high quality and meets specific criteria to qualify for a filtration waiver. One of these criteria, which has been met by DCR, is an adequate watershed control program. The rule emphasizes the need for the watershed control program "to minimize the potential contamination by *Giardia* cysts and viruses in the source water," and requires a level of treatment equivalent to disinfection.

The SWTR establishes minimum requirements of the watershed control program as:

- Assessing the hydrology, land cover, and land use characteristics of the watersheds.
- Describing activities or characteristics of the watershed that may adversely impact source water quality.
- Monitoring and controlling these activities or characteristics.

In addition, the SWTR requires that the public agency responsible for watershed management demonstrates control over the watershed's land, either through land ownership or through agreements with private land owners. There must also be an annual survey by the primacy agency (in this case, DEP) that documents the effectiveness of the watershed control program.

EPA promulgated the Interim Enhanced Surface Water Treatment Rule (IESWTR) in December, 1998. The IESWTR builds on the SWTR, adding requirements of treatment and control for *Cryptosporidium*. The IESWTR adds the specific requirement that unfiltered water systems must maintain a watershed control program to minimize the potential for *Cryptosporidium* contamination, including identifying and monitoring watershed characteristics and activities that may have an adverse effect on water quality. In the IESWTR, EPA states, "it appears that unfiltered water systems that comply with the source water requirements of the SWTR have a risk of cryptosporidiosis equivalent to that of a water system with a well-operated filter plant using a water source of average quality."

DWSP strives to meet all the regulatory requirements set forth for a manager of an unfiltered public water supply as well as a steward of natural and cultural resources.

Table 2: Federal and State Laws and Regulations Affecting OWM Resource Protection Activities

Name	Citation	Regulatory Agency	Description
Safe Water Drinking Act	33 U.S.C. 1251 et seq	US EPA, MA DEP	Surface Water Treatment Rule, Interim Enhanced Surface Water Treatment Rule, and Long Term 2 Enhanced Surface Water Treatment Rule (LT2) are all parts of federal law that protect drinking water supplies.
MA Drinking Water Regulations	310 CMR 22.00	MA DEP	Promotes public health and general welfare by ensuring that public water systems in Massachusetts provide to the users thereof water that is safe, fit and pure to drink.
Federal Endangered Species Act	16 U.S.C. 1531 et seq.	US Fish & Wildlife Service	The purpose of the ESA is to conserve the ecosystems upon which endangered and threatened species depend and to conserve and recover listed species. Under the law, species may be listed as either Endangered or Threatened. Endangered means a species is in danger of extinction throughout all or a significant portion of its range. Threatened means a species is likely to become endangered within the foreseeable future.
MA Endangered Species Act	MGL c. 131 s. 23; 321 CMR 10.00	MA Division of Fisheries and Wildlife	Procedures and rules that establish a comprehensive approach to the protection of the Commonwealth's Endangered, Threatened, and Special Concern species and their habitats.
Federal Americans with Disabilities Act	Public Law 101-336.	US Department of Justice	The ADA prohibits discrimination and ensures equal opportunity for persons with disabilities in employment, State and local government services, public accommodations, commercial facilities, and transportation.
MA Wetlands Protection Act	MGL c. 131 s. 40; 310 CMR 10.00	MA DEP, Local Conservation Commissions	A public review and decision making process by which activities affecting wetlands are to be regulated in order to contribute to the following interests: protection of public and private water supply; protection of ground water supply; flood control; storm damage prevention; prevention of pollution; protection of fisheries; and protection of wildlife habitat.
MA Rivers Protection Act	MGL c. 258, Acts of 1996; 310 CMR 10.00	MA DEP, Local Conservation Commissions	Amendments made to Wetlands Protection Act to provide additional protection to the state's rivers.

Name	Citation	Regulatory Agency	Description
MA Forest Cutting Practices Act	MGL c. 132 § 40 to 46; 304 CMR 11.00	DCR Bureau of Forestry	Protects the benefits of forests through a permitting process. Applicable to timber harvesting on both public and private forestland, the FCPA regulates any commercial timber cutting of wood products greater than 25 thousand board feet or 50 cords on any parcel of land at any one time. This Act also requires the licensing of foresters and timber harvesters.
US Clean Water Act –National Pollution Discharge Elimination System (NPDES)Phase II Stormwater Rules	33 U.S.C. 1251 et seq.	US EPA, MA DEP	The Storm Water Phase II programs, through the use of NPDES permits, implements programs and practices to control polluted storm water runoff from municipal separate storm sewer systems and small construction sites. Phase II is intended to further reduce adverse impacts to water quality and aquatic habitat by instituting the use of controls on the unregulated sources of storm water discharges that have the greatest likelihood of causing continued environmental degradation.
MA Hazardous Waste Site Assessment/ Cleanup	MGL c. 21E; 310 CMR 40.0000	MA DEP	The Massachusetts Contingency Plan lays out a detailed process for when and how contaminated sites must be assessed and cleaned up.
MA Historical/ Archaeological Resource Protection	MGL c. 9 § 26 to 27C; 950 CMR 70.00	Massachusetts Historical Commission	Encourages all governmental bodies and persons considering action that may affect an historical or archeological asset of the commonwealth to consult with the Massachusetts Historical Commission to avoid any adverse effect to such asset.
Massachusetts Environmental Policy Act (MEPA)	MGL c. 30 §61-62H; 301 CMR 11.00	US EOEEA	Provides meaningful opportunities for public review of the potential environmental impacts of Projects for which action is required by an EOEEA agency, and to assist each Agency in using (in addition to applying any other applicable statutory and regulatory standards and requirements) all feasible means to avoid damage to the environment or, to the extent damage to the environment cannot be avoided, to minimize and mitigate damage to the environment to the maximum extent practicable.

Name	Citation	Regulatory Agency	Description
MA Outstanding Resource Waters	314 CMR 4.00	MA DEP	Waters with exceptional socio-economic, recreational, ecological and/or aesthetic values are designated as Outstanding Resource Waters (ORWs) by the MA Surface Water Quality Standards. ORWs include surface Public Water Supplies and their tributaries, wetlands bordering surface Public Water Supplies and their tributaries, certified vernal pools. Discharge of pollutants to a Massachusetts Outstanding Resource Water is severely restricted and requires special review by DEP.

Sources: DCR, MWRA, DEP, EPA, DOJ, and USF&WS.

1.4.3 Filtration Waiver

The combination of Quabbin and Wachusett Reservoirs' size, the watersheds' natural characteristics, and DCR's management activities were a cornerstone to the MWRA's ability to obtain filtration waivers for this water supply. The 412 billion gallon Quabbin Reservoir, with 75% of its watershed in permanently protected land, received a filtration waiver for the Chicopee Valley Aqueduct in 1991. The Wachusett Reservoir, which is smaller than Quabbin, has less protected open space and more development in its watershed, required more analysis by state and federal regulators prior to issuing a waiver for the entire watershed system.

In June, 1993, MWRA and MDC entered into an administrative consent order with the MA Department of Environmental Protection (DEP), which allowed the pursuit of a "dual track" for regulatory compliance with the SWTR for the Wachusett Reservoir. It required MWRA to design and build a filtration plant, unless MWRA could demonstrate with MDC that the system met the criteria for avoiding filtration and DEP determined that filtration was not required. After years of study and research on the needs of the water supply system, review of current information on water treatment effectiveness on pathogens of concern, disinfection byproducts, watershed protection and public health concerns, and input from the public and water supply and public health experts, MWRA concluded that an ozonation/chloramination plant would provide appropriate treatment of the water supply, and that adding filtration to the new plant for $180 million would not provide as much additional benefit as would using funds to rehabilitate old unlined cast iron pipes in the MWRA and local distribution systems.

DEP agreed with MWRA's approach in December 1998 after a hearing and comment period, and determined that filtration was not required for the DCR/MWRA system. EPA, however, did not agree and continued to prosecute the enforcement action previously filed under its SDWA "overfiling" rights, seeking to require MWRA to build a filtration plant, contending that the SDWA allowed no other option. The U.S. District Court ultimately concluded that the comprehensive strategy to improve drinking water proposed by MWRA and MDC/DWM, through watershed protection for Wachusett and Quabbin reservoirs, a new ozonation/ chloramination disinfection facility, and a community pipe rehabilitation program, sufficiently protects public health and cost-effectively improves drinking water quality. (Kurtz, 2000; *U. S. v. MWRA*, 97 F.Supp.2d 155).

The John J. Carroll Water Treatment Plant at Walnut Hill in Marlborough, MA came on-line in July, 2005. The effectiveness of this state-of-the-art facility and ultimately compliance with all safe water drinking regulations relies on OWM maintaining the integrity of the watershed as a barrier against contamination of the source waters. As strongly as any other justification, this relationship requires the level of detail embodied in this land management plan for the Quabbin Reservoir watershed.

1.5 Policy Framework

1.5.1 Land Management Planning and the MA Climate Protection Plan

The role of active land management is increasingly entering the discussion regarding long-term strategies for mitigating the negative effects of global climate change. The Massachusetts Climate Protection Plan was published in 2004, offering a course of action for the problems associated with climate change (for full text, see http://www.massclimateaction.org/pdf/MAClimateProtPlan0504.pdf). The expert assessment cited in this plan states:

> The International Panel for Climate Change (IPCC), a group sponsored by the United Nations and the World Meteorological Organization, representing more than 2,000 leading climate scientists, predicts an average temperature increase of 5-9°F by 2100, although a wider range of outcomes is possible. To put this number in perspective, only about 9°F separates the world at the beginning of the twenty-first century from the world at the end of the last Ice Age, more than 10,000 years ago.

Three of the major predictions in the climate protection plan are directly relevant to this Land Management Plan for a drinking water supply:

1. Extreme weather events, already a characteristic of New England, are likely to become more frequent and cause more damage under a changing climate.
2. Higher temperatures would accelerate evaporation and cause drier conditions and droughts, placing pressure on our water resources, which are already stressed by regional growth.
3. Climate change could have serious impacts on the state's diverse ecosystems and native species, and may encourage the spread of non-native species. (Commonwealth of MA, 2004)

Each of these issues is addressed in various sections of this Quabbin Land Management Plan (see sections on Disturbance (3.4), Water Yield (3.1.2; 4.1.2), and Invasive Species (5.5.5)). The Massachusetts Climate Protection Plan contains specific action objectives for land and forest management under Chapter 10, "Natural Resources Protection as a Climate Strategy", listed below. Specific DCR actions in response to each objective are shown in italics after each objective.

1. HOST WORKSHOPS ON THE POTENTIAL IMPACTS OF CLIMATE CHANGE ON NATURAL RESOURCES AND LAND MANAGEMENT. *DWSP will supplement statewide workshops on this issue by addressing questions through regular public workshops on land management generally held at least annually.*
2. PROMOTE A NEW FOREST VISION THAT INTEGRATES CARBON RESOURCE MANAGEMENT WITH OTHER NATURAL RESOURCE GOALS.
   - [SELECT TREES] THAT WILL INCREASE CARBON STORAGE AND SHEPHERD ADAPTATION TO CLIMATE CHANGE OVER TIME. *DWSP considers these factors whenever plantings occur and as a component in silvicultural decisions. The USDA Forest Service has provided the "Atlas of Current and Potential Future Distributions of Common Trees of the Eastern United States" (General Technical Report NE-265; Iverson et al., 1999), a useful reference for such decisions that indicates that yellow poplar, Virginia pine, sycamore, scarlet oak, southern red oak, blackjack oak, chestnut oak, post oak, and sassafras may become established or increase in abundance in Massachusetts as a result of predicted climate change.*
   - INCLUDE CARBON RESOURCE MANAGEMENT AS ONE CRITERION IN THE MANAGEMENT OF PUBLIC FORESTS. *This criterion is implicit in the overall management objective of maintaining dense, vigorous watershed forests. Wood from watershed management practices may sequester carbon when it is used to manufacture long-lived products such as furniture or houses, or when the carbon it releases when it is burned for heat or energy is recovered by*

regeneration or enhanced growth on the forests from which it was cut. Carbon management is also addressed through DWSP policies that require the retention of standing and fallen dead wood to meet snag tree and coarse woody debris habitat objectives.

3. CONTINUE OPEN SPACE PROTECTION EFFORTS. *DWSP continues to purchase critical parcels of land as well as conservation easements within its watershed boundaries, in order to enhance long-term water supply protection. These purchases, detailed in section 5.1, also add to the overall statewide open space protection efforts.*
4. DEVELOP AND IMPLEMENT A COMPREHENSIVE BIOMASS POLICY. *While it is outside the purview of DWSP to develop such a statewide policy, the agency is participating by providing forest inventory data and by pursuing the potential for using biomass to provide heat and power to DWSP administration buildings within the Quabbin watershed.*

1.5.2 Third-party "Green" Certification of State Forest Lands Management

The 1997 certification of Quabbin Reservoir watershed forestry practices was the first third-party, "green" certification of public lands management in North America. Certification provides third-party review and auditing of forest management practices for the long-term sustainability of their relationship to the environment and to the regional human economy. As the Quabbin certification approached its five-year renewal date, the Executive Office of Environmental Affairs (now the Executive Office of Energy and Environmental Affairs, EOEEA) decided to pursue a broader certification audit; on April 10, 2004, *all* state forest lands in Massachusetts became "green" certified. The Massachusetts state lands certification was granted by Scientific Certification Systems (www.scs1.com), an independent, third-party certification body accredited by the international Forest Stewardship Council (www.fsc.org). Certified lands in Massachusetts are managed by different agencies of the EOEEA, including DCR's Division of State Parks and Recreation (285,000 acres), the Department of Fish and Game's Division of Fisheries and Wildlife (110,000 acres), and DCR's Division of Water Supply Protection (104,000 acres). With this certification Massachusetts becomes the first state in which multiple forest management agencies have joined forces to earn certification of all publicly managed state forest land. Certification is an endorsement, but conditions for improvements in management practices must be attained within a five-year period for this endorsement to remain current and valid.

Final condition number 2002.9 in the MA Certification Evaluation Report requires that this plan for management of the Quabbin DWSP properties must include a determination of the percentage of OWM lands that fall under "High Conservation Value Forest" designation under category 4 (watershed values), and a description of the ways in which management of these lands is consistent with maintaining or enhancing HCVF attributes. On further discussion with the auditor, it was agreed that 100% of these properties meets the criteria for High Conservation Value Forest, and furthermore, that the management practices described herein are fully consistent with category 4 watershed values inasmuch as watershed protection is the priority for all lands under OWM management. The full MA certification report, including the details of these conditions is available online at www.mass.gov/envir/forest/default.htm.

1.5.3 Ecoregional Planning

Another condition in the MA Certification Evaluation Report (pre-condition DEM 2002.1) calls for the initiation of a landscape-level planning process - based on ecoregions - which are intended to provide a blueprint or framework for the development of more detailed site or property management plans. The first of the ecoregion guidance documents was produced in 2004 for the Lower Worcester Plateau (LWP) ecoregion, which includes Quabbin Reservation.

This document - titled *Landscape Assessment and Forest Management Framework: Lower Worcester Plateau Ecoregion in Massachusetts* - identified 14 major management goals for the LWP. These were arranged by category, and include:

Conservation of Biological Diversity:

1) *Enhance and expand the occurrence of contiguous blocks of early and late successional habitats, especially oak types, within the Ecoregion.*
2) *Establish a network of forest reserves in the LWP Ecoregion that provides a wide range of ecological and social benefits.*
3) *Protect the largest, most intact, biologically significant, or most-threatened forest blocks in the ecoregion.*

Forest Conservation:

4) *Prevent new occurrences of non-native, invasive plant species and identify and control existing invasive threats to rare plant populations.*
5) *Restore degraded forests (e.g., formerly high-graded stands, plantations, etc.) to a more natural and native condition.*
6) *Minimize the impact of hemlock wooly adelgid on the forest within the ecoregion.*
7) *Minimize high-grading by encouraging the application of sustainable forest management and conservation biology principles.*

Soil and Water Conservation:

8) *Enhance the protection of the ecoregion's water supplies via improved land conservation and forest management*.
9) *Reduce damage resulting from ORV/ATV activity within the ecoregion.*

Socio-Economic Factors:

10) *Utilize existing state and federal renewable energy programs to support a significant biomass application within the ecoregion.*
11) *Increase the amount of land enrolled in Chapter 61, the Forest Stewardship Program, or other programs that provide significant incentives for landowners to keep land in forest cover.*
12) *Provide more equitable compensation to rural municipalities for the costs of having state lands within their communities.*
13) *Strengthen the regional forest product economy by creating a more consistent and predictable flow of forest products to local forest industries.*
14) *Assure the long-term protection of cultural resources in the LWP ecoregion.*

The ecoregion guidance documents are intended to identify the primary management needs for the ecoregion as a whole, and thus they provide general goals that managers attempt to address when developing individual property management plans. While it is not intended that each plan address every goal, the Quabbin LMP addresses almost all of the goals in the LWP ecoregion guidance document.

Perhaps the greatest contribution that the Quabbin Reservation makes towards the goals of the LWP Ecoregion document is in providing large blocks of intact forest (goal #3), much of which is comprised on native oak stands (goal #1). These stands are carefully managed through sustainable practices that incorporate wildlife and other conservation biology principles (goal #7). Where appropriate, degraded or non-native stands are restored to a more natural or native condition (goal #5). Research and control measures for forest pests like Hemlock Wooly Adelgid are also employed (goal #6), as are surveys and interventions aimed at controlling invasive plants (goal #4). The DWSP designates forest reserve areas within its land holdings (goal #2), and also identifies and protects cultural resources (goal #14).

The vast majority of the forest management work conducted on Quabbin is done through contracts with private loggers, thus providing a significant contribution to the regional forest product economy (goal #13). And until recently, the DWSP funded the preparation of forest management plans for private landowners on the watershed, through its Private Lands Stewardship program (goal #11). Plans are also underway to establish the first biomass heating system in a DCR facility at the Quabbin administration building (goal #10).

Finally, all the forest and land management work being planned and conducted at Quabbin is geared towards the long-term protection of water quality, since the reservoir provides the primary source of drinking water for almost half the population of Massachusetts. Thus, goal #8 essentially constitutes the DWSP's primary mission.

In summary, this update of the Quabbin Land Management Plan not only is consistent with the goals of the LWP Ecoregional guidance document, but should make substantial contributions to the furthering of those goals within the Lower Worcester Plateau ecoregion.

1.5.4 Forest Reserves, Large and Small

Forest reserves are portions of state lands where commercial harvesting of wood products is excluded in order to capture elements of biodiversity that can be missing from harvested sites. Small (patch) reserves will conserve sensitive, localized resources such as steep slopes, fragile soils, and habitat for certain rare species that benefit from intact forest canopies. Large (matrix) reserves are designed to represent the diversity of relatively un-fragmented forest landscapes remaining in Massachusetts today. Matrix reserves may support a wider diversity of tree sizes and ages than typically occurs on harvested sites, as well as structures and processes associated with extensive accumulations of large woody debris that may be absent from harvested sites.

Matrix reserves will ultimately include a wide range of tree sizes and ages, from large, old trees 200-500 years old, to small, young trees that occur in open gaps where old trees have died or been blown over. The trunks and branches of large trees that are toppled during wind storms will accumulate as large woody debris in the forest, and will support decades or even centuries of activity by micro-organisms and invertebrate wildlife that occupy, feed upon, and ultimately break down these massive stores of organic material.

The EOEEA agencies responsible for managing state-owned forestlands (DCR Division of State Parks and Recreation, DCR Division of Water Supply Protection, and DFG Division of Fisheries and Wildlife) have established nine matrix reserves (**Table 3**) that represent the diversity of forest ecosystems that occur within the remaining, relatively un-fragmented forest landscapes of Massachusetts.

Table 3: Large (Matrix) Forest Reserve Sites on State Land

Site Name	Ecological Type	State Lands	Acres
Mt. Greylock	Taconic Mountains ELU (Ecological Land Unit) group 9	Portions of the Mt. Greylock State Reservation	8,500
Mohawk/Monroe/Savoy	Southern Green Mountains	Portions of the Monroe State Forest	7,100
Chalet	Berkshire/Vermont Upland Ecoregion. ELU group 8	Portions of the Chalet, Stafford Hill, and Eugene Moran Wildlife Management Areas, and portions of the Windsor State Forest.	7,112
Mt. Washington	Taconic Mountains ELU group 9	Portions of the Mt. Washington State Forest, and portions of the Jug End State Reservation & Wildlife Management Area	7,155
Middlefield / Peru	Berkshire/Vermont Upland Ecoregion. ELU group 7a	Portions of the Middlefield State Forest.	2,900
Otis	Berkshire/Vermont Upland ELU group 6b	Portions of the Otis State Forest.	769
East Branch Westfield River	Hudson Highlands Ecoregion ELU group 4a	Portions of the Gill Bliss State Forest, and portions of the Hiram Fox Wildlife Management Area.	2,638
Cunningham Pond	Worcester-Monadnock Plateau Ecoregion	Portions of the Ware River Watershed Forest.	3,029
Myles Standish	Cape Cod/Islands Ecoregion	Portions of the Myles Standish State Forest and portions of the Sly Pond Natural Heritage Area.	11,000
TOTAL AREA			**50,203**

The EOEEA agencies have established the following goal, objectives, and benefits for matrix reserves.

Goal: Capture elements of biological diversity that can be missing from harvested sites.

Objectives:

- Retain wood fiber that is typically extracted from the forest ecosystem.
- To the greatest degree possible, allow natural disturbance processes to determine the structure and composition of the forest ecosystem.
- Facilitate biological monitoring to establish baseline data on the species, natural communities, and ecological processes that occur in forest ecosystems reserved from commercial timber harvesting.

Benefits:

- Allow comparison of species, natural communities, and ecological processes on harvested sites with sites reserved from harvest of wood products.
- Provide late-successional forest habitats for wildlife that represent the diversity of forest ecosystems in Massachusetts.
- Inform management of harvested sites with knowledge of structural attributes that develop on reserve sites.
- Provide unique recreational and aesthetic opportunities in biologically mature forest habitats that will develop over time in reserves.

Within DWSP properties surrounding Quabbin Reservoir, approximately 12,000 acres have been identified as "small reserves", consisting of steep slopes, wetlands, rare species habitat, islands, identified natural areas such as the Pottapaug Pond Natural Area, sensitive cultural resource areas, and areas that are inaccessible for a variety of reasons. See section 5.5.4 for further details; for more information on statewide reserves, go to www.mass.gov/envir/forest/pdf/whatare_forestreserves.pdf.

1.6 DCR/DWSP/OWM Planning Process

DWSP is engaged in an on-going planning process, consistent with legislative, regulatory, and court mandates, to maintain the watershed system's superior water quality. There are three critical plans prepared for each watershed via the DWSP planning process, including a Public Access Management Plan, a Land Management Plan, and a Watershed Protection Plan.

The Public Access Management Plan describes the management policies that allow people to recreate on DWSP lands while still protecting water quality. The Land Management Plan is a thorough description of the watershed's physical features, the natural resources on DWSP property, and the variety of techniques used by the agency to enhance water quality, including land protection, forest and wildlife management, cultural resource protection, and the protection of biological diversity. Implementation of the Land Management Plans is a key requirement for the continued independent "green" certification of DWSP forestry activities. The Watershed Protection Plan takes information from the Public Access Plan and Land Management Plan and integrates water quality monitoring findings and other studies to create an action plan that is the basis for DWSP's annual work plan and budget. The Watershed Protection Plan acts as an "umbrella," encompassing all efforts by DWSP that affect both public and private lands in the quest to provide the highest quality drinking water in the world.

Additional studies and reports utilized in the Watershed Protection Plan include: the Land Acquisition Plan, DWSP's guide to purchasing properties that are critical to long-term water quality protection; annual Water Quality Reports and basin specific Environmental Quality Assessments that identify water quality trends, link problems to sources of contamination, and develop prioritized goals for corrective actions; and Emergency Action Plans that detail the necessary steps and chain of command required in case of a catastrophe associated with the reservoirs. Stormwater Management, Agriculture, and Hazardous Materials Emergency Response are examples of topics that have come under special study.

This comprehensive approach to watershed planning has made it possible for MWRA to maintain a waiver from federal filtration requirements and make the Office of Watershed Management a national model. While consultants are utilized when necessary for specific expertise, the vast majority of these plans and outreach material are developed by DWSP staff. **Table 4** provides a summary of the status of DWSP's plans, including the current version, term, and history. Recent plans, fact sheets and newsletters are available on-line at www.mass.gov/dcr/waterSupply/watershed.

Table 4: DCR/DWSP/Office of Watershed Management Planning Summary

Type of Plan	Latest Publication	Term	Next Planned Revision	History (Consultant)
Watershed Protection Plans				
Quabbin Reservoir/Ware River	2000	5-8 years	2008	1991 (Rizzo)
Wachusett Reservoir	2003	5 years	2008	1991 (Rizzo), 1998 (CDM)
Sudbury Reservoir System	1997	As Needed (Emergency Reserve – WPP not required)		(CEI)
Land Management Plans[1]				
Quabbin Reservoir	1995	10 years	2007	1961, 1972, 1986
Ware River	2003	10 years	2013	1986
Wachusett Reservoir	2001	10 years	2011	
Sudbury Reservoir System	2005	10 years	2015	
Public Access Management Plans				
Quabbin Reservoir	1998	5-10 years	2005	1988
Ware River	2000	5-10 years	2010	1988
Wachusett Reservoir	2003	5-10 years	2013	1996
Sudbury Reservoir System	2002	5-10 years	2012	1994
Other Plans and Reports				
DWSP Fiscal Year Work Plan	2006	1 year	2007	2005
Land Acquisition Plan[2]	2006 (draft)	5 years	2011	1998
Emergency Action Plans (w/MWRA)	2005 Review	Annual Review	2006	1993–1995 (GZA and GEI)
Stormwater Management	1999	As Needed		(CDM)
Agriculture	1998	As Needed		(CEI)
Highways/Railways Hazardous Material Release Control Project	1998	As Needed		(Rizzo)
Hazardous Materials Emergency Response Plans	1997	As Needed		(CEI)
Water Quality Reports				
Annual Water Quality Report	2007	1 Year	2008	Annually since 1987
Environmental Quality Assessments (Replaced Sanitary Surveys in 2000)	2004	5 years	On-going (1 sub-basin/year)	Sanitary Surveys: 1988–2000. EQAs: 2000-present

[1] Cutting plans are developed annually to guide specific forestry activities.
[2] A list of properties is developed semi-annually for review by the MWRA Board of Directors.
All plans produced by DWSP staff unless noted otherwise.

1.7 Land Management Planning and Public Review and Input Process

1.7.1 Planning and Advisory Committee Mandate

Chapter 92A½, Section 13 establishes the Quabbin watershed advisory committee (QWAC), its membership and its purpose (see **Appendix 9.2.4**). Chapter 92A½,: Section 16 regarding "periodic watershed management plans" states that the agency shall periodically "produce watershed management plans, which shall have been prepared with the participation of a professionally qualified forester and the appropriate watershed advisory committee" (see **Appendix 9.2.3**). The Quabbin Watershed Advisory Committee has established a subcommittee on forestry and wildlife management. This subcommittee works with the Natural Resources and Quabbin Section staff to develop and review drafts of the land management plans for Quabbin.

1.7.2 Public Input to DCR/DWSP's Land Management Plans

Public outreach is an important element of the success of DWSP's watershed protection efforts. As managers of public land, DCR/DWSP staff has a responsibility to solicit public input in order to address concerns, explain existing management practices, and integrate new ideas, when practical, in order to provide the best possible protection for the drinking water supply. Each plan seeks input from a variety of perspectives—such as legislatively mandated watershed advisory groups, visitors, abutters, and user interest groups—through public meetings, the press, and the DCR website. In addition to hearings and informational meetings on plans, DWSP supports an ongoing discourse with the public on water supply protection strategies through individual contact with interpretive staff and DWSP Watershed Rangers, implementation of the Watershed Protection Act, municipal technical assistance, fact sheets, and the bi-annual newsletter *Downstream*.

The goals of the Division's public input process for land management planning are to:

- Regularly solicit public input in order to better understand the broad range of current public issues and concerns regarding forest and wildlife management, so that the Division can better integrate these concerns into protection strategies and the development of goals and objectives for maintaining watershed integrity.
- Educate the public regarding the development of goals and objectives of the Division with regard to its land management program.
- Improve the understanding of both agency staff and the public regarding the technical aspects of forest and wildlife management on the Division's watersheds.
- Educate the public regarding Division implementation of the land management program, in order to address concerns and retain public confidence in these practices.

1.7.3 Monitoring and Regular Revisions to the Quabbin Land Management Plan

DCR and MWRA are dedicated to watershed protection as part of a multi-barrier approach to protecting drinking water quality. Updating a plan provides the opportunity to consider the implementation of DWSP's programs, integrate increased knowledge of water quality protection and watershed sources of concern, and set a focused watershed protection agenda. Among the issues considered by DWSP are changes in population, trends in recreation and public access, development of new technologies, and advances in scientific research. The implementation of these plans is also considered an opportunity to test the principles on which they are based. Through both internal and outside monitoring of the Division's practices, it periodically becomes desirable to make adjustments to plans within the current management period. This adaptive management approach allows for fine-tuning of practices based on new information. However, as these plans are subject to public review and comment prior to their

implementation, any proposed changes will be presented at a public meeting prior to being incorporated in the plan or its implementation. These public meetings will be scheduled on an annual basis and will include reporting on implementation progress, findings from monitoring efforts, and proposals for refinements to the plan based on these monitoring efforts. In addition to announcing these meetings to the general public, QWAC and the scientific and technical advisory committee described below will be encouraged to attend.

Over the past 5-6 decades of management of the lands surrounding Quabbin Reservoir, monitoring of the effects of implemented practices on natural and cultural resources has occurred regularly, although limited somewhat by budget and staffing. This monitoring has included establishment of permanent Continuous Forest Inventory plots and their remeasurement consistently every 5 or 10 years (see section 2.4.2.3). Regeneration and the effects of browsing by deer have been monitored annually since 1989 (see Appendix IV), and a variety of techniques are being tested for monitoring moose populations (see section 5.4.4.5.3). The Environmental Quality staff have monitored water quality at multiple locations throughout the watershed on an annual or monthly or storm-based schedule since shortly after the establishment of the reservoir. A mix of Natural Resources, Forestry, Environmental Quality, and Watershed Maintenance staff provide regular monitoring of the condition and sufficiency of access roads, gates, bridges, culverts, and related infrastructure. Wildlife populations have been monitored using a wide variety of methods for many years (for example, beaver populations on the Prescott Peninsula have been surveyed regularly since 1952 – see sections 2.5.2.2 and 5.4.4). Rare plants are identified on an ongoing basis, as encountered, and then monitored by DWSP Natural Resources staff as well as volunteers from the New England Wild Flower Society on a regular basis. Rare wildlife is surveyed regularly by a combination of DWSP Natural Resources and Natural Heritage and Endangered Species staffs, and recommended practices to protect and enhance these populations have been upgraded recently through collaborative review of management effects. In addition to monitoring efforts involving DWSP staff directly, the agency relies on reports from researchers who conduct both short term and long term studies of a wide variety of watershed resources and processes. Their work is frequently published in refereed scientific journals, but is also available to the public by request.

As a result of the terrorist attacks of September 11, 2001, all public water suppliers were forced to increase their focus on monitoring and improving the security of the public water supply. The security of the water system is among the highest priorities for the Division and the MWRA. The Division's security policies are periodically reviewed in order to achieve the goal of providing a safe and secure water supply system through a system that is constantly updated in response to new information. Security of the water system is designed to be comprehensive – source to tap – but flexible enough to adjust to a range of potential threat conditions. Regular monitoring and updating of security as it relates to such infrastructure as access roads or is a component of the land management planning process.

1.7.4 Scientific and Technical Review (QSTAC)

In the fall of 1996, the MDC/DWM assembled the first meeting of the Quabbin Science and Technical Advisory Committee. This committee includes professional forest, wildlife, and natural resource researchers and managers from state agencies (DCR/DWSP; DCR Bureau of Forestry; Department of Fish and Game, Division of Fisheries and Wildlife), the University of Massachusetts Departments of Natural Resources Conservation and Civil and Environmental Engineering, Harvard Forest, the USDA Forest Service, Mount Holyoke College, Amherst College, the Institute of Ecosystem Studies, USGS, Massachusetts Audubon Society, the New England Small Farms Institute, the MA Natural Heritage and Endangered Species Program, and Hampshire College.

The Science and Technical Advisory Committee was formed to convene as needed to address major natural resources and watershed management issues and changes in the Land Management Plan, and to advise DWSP in the development and implementation of scientific research to address concerns at Quabbin. The committee is intended to function as the "bridge" between professional research and management. In addition to general advice, the committee has assisted in the following special issues: setting of research priorities, development of standards for research quality assurance and control, subwatershed modeling, determination of appropriate sizes for regeneration openings, decisions with regard to future designations of lands reserved from management, management considerations for the Pottapaug Natural Area, and the development of a policy for the treatment of watershed areas affected by the hemlock woolly adelgid. The committee met annually from 1996 through 2000 and sub-groups have been called upon occasionally to address current issues.

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